

TRANSMISSION MATERIALS STANDARD SPECIFICATION

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الشركة السعودية للكهرباء
Saudi Electricity Company

01-TMSS-01

Revision No. 01

GENERAL REQUIREMENTS FOR ALL EQUIPMENT/MATERIALS



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1.0 SCOPE

This Specification describes the general requirements applicable to all SEC Transmission Material Standard Specifications (TMSSs) for use in the Transmission System of Saudi Electricity Company (SEC), Kingdom of Saudi Arabia. Accordingly, all the TMSSs shall always be read in conjunction with this Specification.

2.0 MANUFACTURING AND FIELD EXPERIENCES

The equipment/material manufacturer shall have at least ten (10) years of manufacturing experience, with a minimum of five (5) years successful field experience preferably in the international market and in similar service conditions. The equipment/material shall be Type and Routine tested according to applicable Industry Standards.

In-Kingdom Manufactureres for whom ten (10) years of manufacturing experience and five (5) years of successful field experience can not be met, on similar equipment/material, manufacturer plant may be considered for prequalification subject to the satisfactory completion of type, special and routine tests as specified in the applicable TMSS.

For new technology equipment/material, where the specified five (5) year field experience requirement cannot be met, a minimum of two (2) years of field service experience at the time of prequalification might be considered at the sole discretion of Transmission Business Line (TBL) of SEC with the concurrence of all the concerned departments within TBL.

3.0 CODES AND STANDARDS *Comply whenever Applicable*

- 3.1 The tendered equipment/material shall fully conform to or exceed the minimum requirements stipulated herein and the TMSS for the said equipment/material.
- 3.2 Items not specifically covered herein and in the TMSS for the said equipment/material, shall conform to the latest editions of referred Industry Codes and Standards.
- 3.3 It shall be the bidder's/contractor's/manufacturer's/vendor's responsibility to be or become knowledgeable of the requirements of the latest Industry Codes and Standards listed in the associated TMSS and bring to the attention of the Company, any latest revisions/amendments of the referred Industry Codes and Standards which may have an impact on the technical requirements of the TMSS.
- 3.4 If the bidder/contractor/manufacturer/vendor uses equivalent Codes and Standards, he shall clearly mention the same in his bid proposal and obtain TBL's approval before proceeding with manufacture. The equivalent Codes and Standards shall be equal to or better than those specified in the associated TMSS and the manufacturer shall have extensive experience in using these equivalent Codes and Standards.

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Copy of the equivalent Codes and Standards and the comparison with the specified Codes and Standards shall be provided to TBL for review and acceptance.

- 3.5 If the bidder/contractor/manufacture/vendor has Environmental Management System (EMS) in compliance with ISO 14000 in his organization, he shall clearly mention the same in his bid proposal and submit certificates/documents to prove his compliance for TBL review and acceptance.
- 3.6 It shall be noted that TBL's interpretation of this Specification as well as the associated TMSSs shall be binding on the bidder/contractor/manufacture/vendor.
- 3.7 In case of any apparent conflict in requirements, the order of precedence shall be:
- 3.7.1 TBL Purchase Order or Contract Schedules, as applicable
 - 3.7.2 TMSSs for the said equipment/material
 - 3.7.3 This Specification
 - 3.7.4 Applicable TBL Engineering Standards (TES)
 - 3.7.5 Applicable TBL Construction Standards (TCS)
 - 3.7.6 Other applicable Industry Codes and Standards
- 3.8 The following acronyms are used in the various TMSSs:
- 3.8.1 Company Codes and Standards:
- * TBL : Transmission Business Line.
 - * COA : Central Operating Area.
 - * WOA : Western Operating Area.
 - * EOA : Eastern Operating Area;
 - * SOA : Southern Operating Area.
 - * CTA : Consolidated Transmission Area.
 - * DTA : Developing Transmission Area.
 - * TMSS : Transmission Material Standard Specification.
 - * TES : Transmission Engineering Standard.
 - * TCS : Transmission Construction Standard.
 - * SEEDS I : Preparing, Processing and Managing Transmission Drawings/Documents.

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- * SEEDS II : Saudi Electricity Company Engineering Drawings Standard..
- * SOW/TS : Scope of Work and Technical Specification.
- * PTS : Project Technical Specification.

3.8.2 National Codes and Standards:

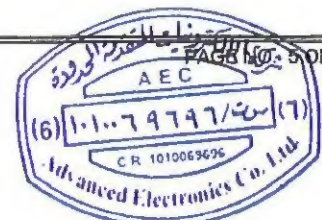
- * SASO : Saudi Arabian Standards Organization.
- * EU : Electricity Utilities.

3.8.3 International Codes and Standards:

- * AASHTO : American Association of State Highway and Transportation Officials.
- * ABMA : American Bearing Manufacturers Association.
- * ACI : American Concrete Institute.
- * AEIC : Association of Edison Illuminating Companies.
- * AISC : American Institute of Steel Construction.
- * AMCA : Air Movement and Control Association Inc..
- * ANSI : American National Standards Institute.
- * API : American Petroleum Institute.
- * ARI : Air-Conditioning and Refrigeration Institute.
- * ASHRAE : American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- * ASCE : American Society of Civil Engineers.
- * ASME : American Society of Mechanical Engineers.
- * ASNT : American Society for Non-Destructive Testing Inc..
- * ASSE : American Society of Sanitary Engineering.
- * ASTM : American Society for Testing & Materials.
- * AWWA : American Water Works Association.
- * AWS : American Welding Society.
- * BS : British Standards Institution.
- * CISPR : International Special Committee on Radio Interference.

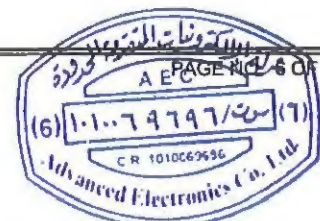


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- * CIGRE : International Council on Large Electric Systems.
- * EIA : Electronic Industries Alliance.
- * ETL : Electrical Testing Laboratories Inc.
- * FM : Factory Mutual Research Corporation.
- * ICEA : Insulated Cable Engineers Association.
- * IEC : International Electrotechnical Commission.
- * IEEE : Institute of Electrical and Electronic Engineers.
- * IES : Illumination Engineering Society.
- * ISA : The Instrumentation, Systems and Automation Society.
- * ISO : International Organization for Standardization.
- * ITU-T : International Telecommunication Union - Telecommunication Sector.
- * JEDEC : Joint Electric Devices Engineering Council Standard.
- * MSS : Manufacturers Standardization Society of the Valve and Fitting Industry Inc.
- * NEBB : National Environmental Balancing Bureau.
- * NEC : National Electrical Code.
- * NEMA : National Electrical Manufacturers Association.
- * NESC : National Electrical Safety Code.
- * NSF : National Sanitation Foundation.
- * OSHA : Occupational Safety and Health Administration.
- * NFPA : National Fire Protection Association.
- * TIA : Telecommunications Industry Association.
- * UBC : Uniform Building Code.
- * UL : Underwriters Laboratories.
- * UPC : Uniform Plumbing Code.

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4.0 SYSTEM PARAMETERS

Unless otherwise specified in the associated data schedule of TMSS, the equipment/material shall be suitable to operate under the typical system parameters as shown in Table-1 and shall meet the minimum requirements given in clause 4.2 and 4.3.

Table - 1

| Nominal System Voltage (kVrms) | Rated Voltage for Equipment (Maximum System Voltage) (kV) | Three Phase Symmetrical Short Circuit Current. (kA) | Short Circuit Current Duration (Sec) |
|--------------------------------|---|---|--------------------------------------|
| 11 | 12 | 25 | (1 or 3) * |
| 13.8 | (15 or 17.5)** | 25 | (1 or 3) * |
| 33 | 36 | 25 | 1 |
| 34.5 | 36(minimum) | 25 | 1 |
| 69 | 72.5 | (31.5 or 40)* | 1 |
| 110 | 123 | 40 | 1 |
| 115 | 123 | 40 | 1 |
| 132 | 145 | 40 | 1 |
| 230 | 245 | 63 | 1 |
| 380 | 420 | 63*** | 1 |

* - It shall be specified by the design engineer.

** - Unless otherwise specified in the SOW/TS, switchgear shall be rated 17.5 kV and for other equipment it shall be as specified in the SOW/TS.

***- 50kA if required shall be specified in the SOW/TS

4.1 Frequency

comply

The nominal frequency for TBL system is 60 Hz and the permissible operating frequency range is between 59.9 Hz and 60.1 Hz.

4.2 System Voltage

comply

The permissible operating voltage range is $\pm 5\%$.

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4.3 Neutral Arrangement

Comply

Unless otherwise specified in the associated data schedule of relevant TMSS, the system neutral shall be solidly grounded for all transmission service voltages.

4.4 Harmonics

comply

Equipment/materials connected to SEC transmission system shall not impose voltage harmonics exceeding the following limits:

Table - 2

| | Transmission Voltage | Medium Voltage |
|--|----------------------|----------------|
| Total Harmonic Voltage Distortion | 1.5 % | 5 % |
| Individual Harmonic Voltage Distortion | 1.0 % | 3 % |

Notes:

1. Voltage distortion is expressed as a percentage of the nominal voltage.
2. Individual harmonic distortion refers to the distortion at an individual harmonic frequency. Total harmonic distortion refers to root mean square value of the distortion at all harmonic frequencies.
3. The individual values refer to maximum continuous levels.
4. Equipment/materials connected to the transmission system shall not impose voltage harmonics on the system, which exceeds the above limits.
5. When no such limits are specified in selected cases, the limits shall be as per IEEE Standard 519.

4.5 Creepage Distance

4.5.1 Switchyards/Substations *NOT Applicable*

- a. All outdoor bushings/insulators for switchyards/substations shall have a minimum creepage/leakage distance of 40 mm/kV, nominal voltage, line to line.
- b. All air insulated bushings/insulators mounted inside cable box/cabinet of equipment installed outdoors shall have minimum creepage/leakage distance of 25 mm/kV.

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c. Transmission Lines *Not Applicable*

- i. All outdoor (Porcelain and Glass) insulators for transmission lines shall have a minimum creepage distance as per Table-3 below:

Table - 3

| Area Classification | Minimum Creepage Distance mm/kV (Line to Line, Nominal) | | | |
|---------------------|--|------|------|------------|
| | COA | WOA | EOA | SOA |
| Inland Area | 31 | 40 | 40 | (31 & 40)* |
| Coastal Area | Not Applicable | 50** | 50** | 50** |

* - To be selected by the design engineer based on the past performance in the project area.

** - Coastal Area is defined as the area located within a distance of 100 km from the Coastline for CTA (EOA) and 50 km for DTA (WOA & SOA). Whereas the area beyond these limits is defined as Inland Area.

- ii. All outdoor polymer insulators (Silicone Rubber) for transmission lines located in Coastal Area shall have a minimum creepage/leakage distance of 40 mm/kV, nominal voltage, line to line.
- iii. Transmission lines connecting two different operating areas shall have the creepage distance equal to that of the operating area which has higher value.

4.5.2 Indoor Installations *Comply*

The minimum creepage/leakage distances for indoor installations shall be as shown in Table-4 below:

Table - 4

| | |
|----------|---|
| 12 mm/kV | For enclosed insulators such as those installed inside metalclad switchgear or cabinet which are type tested for impulse level and routine tested for power frequency withstand voltage |
| 25mm/kV | For exposed insulators such as wall bushings |

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4.6 Insulation Levels *Not Applicable*

The insulation levels for all equipment shall not be less than the values specified.
Insulation levels are divided into the following categories:

4.6.1 Common Value:

Refer to Table-5.

4.6.2 Across Isolating Distance:

Refer to Table-6.

4.6.3 Insulation Levels for 380kV System:

Refer to Table-7.

4.6.4 Basic Switching Impulse Level for 380 kV System (BSL):

Table - 8

| System Nominal Voltage (kVrms) | | 380 | | | | | |
|--------------------------------|-----------------|---|------|----------------|------|---------------------------|---------------|
| BSL | | Phase to Earth and Across Open Switching Device | | Between Phases | | Across Isolating Distance | |
| | | G | O | G | O | G | O |
| | Outdoor | 1050 | 1050 | 1575 | 1680 | 900 (+345) | 900 (+450) |
| | Indoor/Internal | 1050 | 950 | | 1425 | 900 (+345) | 900 (+345) |

G : Values applicable for GIS.

O : Values applicable for other equipment

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4.5.6 Insulation Levels for low voltages (AC&DC): *Comply*

Table - 9

| System Nominal Voltage (Vac) | BIL (kV Peak) | Power Frequency Withstand Voltage (kV rms) |
|------------------------------|---------------|--|
| 600/1000 | 8 | 3 |
| 277/480 | 6 | 2 |
| 230/400 or 220/380 | 6 | 2 |
| 220/127 | 4 | 2 |

Table - 10

| System Nominal Voltage (Vdc) | BIL (kV Peak) |
|------------------------------|---------------|
| 48 | 1.5 |
| 110/125 | 4 |

Notes:

1. External insulation refers to the insulation of equipment exposed to the open air which will be influenced by atmospheric conditions, such as pollution and humidity. External insulation is further categorized into two categories:
 - i. Outdoor insulation which is totally susceptible to atmospheric radiation, pollution, humidity, sandstorms and such other vagaries of nature.
 - ii. Indoor insulation which is installed inside a building or outside a building but inside an enclosed box such as cable box, terminal box, etc. where it is not directly subjected to outdoor atmospheric extremities.
2. Internal insulation refers to the insulation of equipment immersed in a dielectric medium such as insulating fluid, or totally encapsulated in a solid dielectric, and not exposed to atmospheric conditions.
3. For installations at an altitude higher than 1000 m, the external air insulation levels in the tables above shall be calculated by multiplying the insulation withstand voltage (BIL) required at service location by altitude correction factor K_a as specified in IEC 62271-1.

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K_a is calculated from the formula $K_a = e^{m(H-1000)/8150}$
Where H = Altitude above sea level (in meters).

5.0 SERVICE CONDITIONS

Unless otherwise specified in the associated TMSS, the equipment/material shall be suitable to operate under the typical system parameters as stated below under normal and single contingency emergency situation and shall meet the minimum requirements given in clause 4.5 and 4.6 at service conditions specified:

| | | | | |
|--------|-------|--|---|---|
| Comply | 5.1 | Altitude above mean sea level, as specified in PTS/SOW (MSL) | : | 0-1000 m or 1001 – 3000 m |
| | 5.2 | Ambient Air Temperature (Outdoor): | | |
| Comply | | Minimum | : | - 5°C |
| Comply | | Maximum | : | 55°C |
| Comply | | Monthly average of the hottest month | : | 45°C |
| Comply | | Monthly average of the coldest month (to be used for Conductors Damping Study) | : | - 5°C |
| Comply | | Yearly average | : | 35°C |
| | 5.3 | Maximum Ambient Air Temperature (Indoor) for switchgear building | : | 40°C |
| Comply | | Other Air conditioned buildings | : | 25°C |
| Comply | | Ventilated Buildings, with forced air and/or exhaust fans where no air conditioning is provided. | : | 40°C |
| Comply | 5.4 | Ambient ground temperature | : | 40°C |
| Comply | 5.5 | Maximum relative humidity | : | 80-100% |
| Comply | 5.6 | Contamination level: | | |
| | 5.6.1 | Equivalent Salt Deposit Density (ESDD) | : | 0.55 mg/cm ² (Coastal Area). 0.30 mg/cm ² (Inland Area). |
| Comply | 5.7 | Average rainfall per year | : | 150-330 mm |

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- Comply* 5.8 Design Wind Velocity (Unless otherwise stated in Data Schedule of the relevant TMSS). : 150 km/h
- Comply* 5.9 Approximate highest density solar radiation averaged over the summer months. : 1.10 kW/m²
- Comply* 5.10 Isokeraunic level (Average) : 10 storm days/year.
Isokeraunic Level (Maximum) : 50 storm days/year.
- Comply* 5.11 Maximum Earthquake frequency/severity (Unless otherwise specified for specific zone) : 0.2 g.
- Comply* 5.12 All equipment/material and accessories shall be designed for satisfactory operation/performance based on the above (Indoor or Outdoor or Underground) service conditions, unless otherwise specified in associated TMSS.
- Comply* 5.13 All outdoor equipment enclosures/material shall be weatherproof and all metal parts shall be corrosion and abrasion resistant, and the degree of protection shall be IP54 as per IEC 60529 or NEMA Type 4X as per NEMA 250. The degree of protection for all indoor equipment shall be IP41 as per IEC 60529 or NEMA Type 3 as per NEMA 250. The degree of protection for medium voltage metalclad switchgear shall be IP 40 as per IEC 60529.
- whenever Applicable*

6.0 PROTECTIVE COATINGS

Unless otherwise specified, the equipment/material shall be protected from corrosion either by hot-dip galvanizing or painting or by a combination of galvanizing and painting (a duplex system). The duplex system shall be required as per Table below and/or as specified and described in the relevant TMSS and SOW/TS.

6.1 Galvanizing *Comply whenever Applicable*

- 6.1.1 Hot-dip galvanizing for steel structures shall meet the requirements of ASTM A123. The minimum average thickness of zinc coating shall be as per Table-11 below:

Table - 11

| Area Classification | Zinc Coating Thickness, mm (g/m ²) | | | |
|---------------------|--|--|---------------|--|
| | COA | WOA | EOA | SOA |
| Inland Area | 0.086 (610) | 0.086 (610) | 0.13 (915) | 0.086 (610) |
| Coastal Area | Not Applicable | 0.086 (610) Plus Paint (Duplex System)* | 0.13 (915) | 0.086 (610) Plus Paint (Duplex System)* |

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* - Duplex System (combination of paint and hot-dip galvanizing) shall be used within 25km radial distance from the Coastline. Whereas, zinc coating thickness for all other areas beyond 25km from the Coastline shall be same as for Inland area.

- 6.1.2 ASTM A153 for Hardware Fittings, Caps of Insulators and Fasteners (bolts, nuts and washers). The minimum average thickness of zinc coating shall be 0.110 mm (770g/m²) for hardware fittings/caps of insulators.

The minimum average thickness of zinc coating for bolts, nuts and washers shall be:

- a. 0.053 mm (381 g/m²), for fasteners over 9.52 mm in diameter.
- b. 0.043 mm (305 g/m²), for fasteners of diameter 9.52 mm and under.
- c. 0.053 mm (381 g/m²), for spring steel washers such as Belleville Washers (mechanically galvanized in accordance with ASTM B 695).

- 6.1.3 The galvanizing thickness shall be as per manufacturer's standard for all other equipment such as circuit breakers, disconnect switches, etc.

6.2 Painting *Comply whenever Applicable*

- 6.2.1 Painting shall be a combination of compatible paints comprising of primer, intermediate coat (on as needed basis) and top coat(s) to achieve optimum protective and decorative coating against atmospheric corruptions caused by tropical climatic conditions, wind blown dust, sand, salt, high humidity and temperature fluctuations.

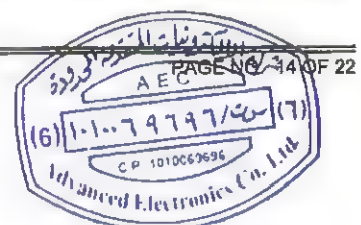
- 6.2.2 For all equipment used in transmission substations or transmission system, color shall be light aircraft gray shade per BS 627, Munsell N7 or RAL 7038 conforming to BS 381C/2660, ASTM D1535 or German DIN Specifications and Certification, respectively.

For all distribution equipment installed in the Transmission system, color shall be cement gray shade per Munsell No. 5.0 BG 7.0/0.4 or RAL 7033 conforming to BS 381C/2660 or ASTM D1535, respectively.

- 6.2.3 Manufacturer's standard painting system shall be acceptable provided that the following paint performance requirements of TBL are met:

- a. The paint coating shall be deemed to last the life of the equipment/material.
- b. The paint coating shall be capable of withstanding the effect of ultraviolet rays or direct solar radiation at its installed location without change in color and material degradation.

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- c. When a paint coated equipment/material is tested for abrasion, there shall be no penetration through the paint coating to the substrate.
- d. When a paint coated equipment/material is tested by impact, there shall be no cracking of the paint coating or any detachment from the substrate.
- e. Painted or coated equipment/material installed outdoor shall be tested by salt spray for 1000 hours per ASTM B117, whereas equipment/material installed indoor shall be tested by salt spray according to manufacturer's procedure or for 250 hrs whichever is higher.

There shall be no blistering, softening or detachment of the paint coating. There shall be not more than 1.0 mm of corrosion creep from the scribed, equivalent to rating number 8, in accordance with Table 1 of ASTM D1654.

- f. After the equipment/material has been washed with water and allowed to dry for 24 hours, it shall be tested for adhesion using Method B in accordance with ASTM D3359. The adhesion scale shall be 5B, wherein the edges of the cuts are completely smooth and none of the square of the lattice is detached, unless within 1.0 mm of the scribed.
- g. When a paint coated equipment/material is tested for its resistance to humidity, there shall be no blistering, softening or detachment of the coating nor signs of corrosion of the equipment/material.

6.3 Duplex System *Comply whenever Applicable*

- 6.3.1 Duplex system of protection of equipment/material from corrosion shall be a combination of hot-dip galvanizing and painting.
- 6.3.2 The duplex system shall be deemed to have a life at least 30 years or more.
- 6.3.3 The paint system shall comprise of one primer coat, intermediate coat(s), and top (finish) coat(s). The thickness of zinc coating shall be a standard thickness as per ASTM A123 whereas the thickness of paint shall be as per manufacturer's recommendations and subject to approval by TBL or by its designated representative.
- 6.3.4 Complete details of the paint system and procedures for application shall be submitted for review and approval by TBL or by its designated representative.

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[Signature]



6.4 Underground Materials

Unless otherwise specified, the manufacturer/vendor shall propose appropriate corrosion protection measures, other than specified above, for the application of material for underground installation for TBL review and acceptance.

7.0 INSPECTION AND TESTING

- Comply 7.1 TBL reserves the right to inspect the equipment/material at the factory, as TBL deemed necessary, for compliance with the terms and conditions of the Purchase Order and/or the Project Scope of Work & Technical Specifications (SOW/TS) and to witness any or all the tests required by the aforementioned documents and the associated TMSS.
- Comply 7.2 TBL may require certificates and data from the manufacturer/ supplier on all pertinent aspects of the manufacturing process.
- Comply 7.3 In order to permit TBL or its designated representative to be present for inspection and tests, the contractor/manufacturer/vendor shall give a minimum of 30 days advance notice of his intention to carry out tests on equipment/material being made available for inspection. In the case of tests of long duration, the actual date of commencement shall be mutually agreed between the contractor/manufacturer/vendor and TBL or its designated representative.
- Comply 7.4 No equipment/material shall be delivered to the Company until the manufacturer receives a signed "Release for Shipment Certificate" from TBL or its designated representative. Release for shipment certificate is required prior to dispatch of any equipment/material even if TBL or its designated representative does not perform inspection or surveillance activity at the manufacturer's facility.
- Comply 7.5 Issuance of the Release for Shipment Certificate shall not be construed as waiving any of TBL rights to carry out receipt inspection at TBL receiving facilities or contractor's material storage yard and rejection of the equipment/material if not complying with the Purchase Order and the Specifications.
- Comply 7.6 Vendor/manufacturer shall submit Quality Control Plan/Inspection and Test Plan (QCP/I&TP) of the proposed equipment/material per Contract Schedules or three (3) to four (4) weeks after receipt of the Purchase Order and prior to commencement of the manufacturing for review and approval by TBL.
- Comply 7.7 The Quality Control Plan shall list and define in sequential order all process control activities, inspection and tests (design, routine and special) required and proposed to be performed on the equipment/material starting from component procurement, assembly and testing stages to product dispatch. The Quality Control Plan shall indicate and

identify the applicable standard, detailed description with diagram of the procedure, acceptance criteria, extent check and record to be generated, reviewed and retained.

8.0 PACKING AND SHIPPING

8.1 All equipment/material shall be delivered within a period not exceeding two (2) years from date of completion of manufacture.

comply

8.2 Export packing and shipping shall be adequate for sea transport and handling up to site in Saudi Arabia.

comply

8.3 Each assembly or component shall be skidded, crated, boxed or otherwise suitably protected against damage or loss during shipment and to facilitate field hand storage. All openings shall be effectively sealed with temporary closures to prevent entry of dust, dirt, moisture and other foreign matter.

comply

8.4 Each crate or container shall be marked with the number of pieces contained therein, the manufacturer's catalog number and description of the content, the manufacturer's name, Country of origin, TBL Item Number, TBL Purchase Order Number, Contract No. or I.O. No. and the gross weight in kg.

comply

8.5 Additional handling and shipping instructions if specified in SOW/TS or in Purchase Order and/or by Materials Management Department, or other concerned departments, shall also be applicable.

comply

9.0 DOCUMENTATION REQUIREMENTS

9.1 General *comply*

9.1.1 English language shall be used at all times with respect to documents, drawings and labels procured or prepared by the contractor/manufacturer/vendor pertaining to the work.

9.1.2 Preparation of as-built documentation shall comply with the requirements of SEEDS I and SEEDS II.

9.1.3 All documentations such as manuals, catalogues, etc. shall be submitted in hard copy and electronic copy in Acrobat Reader format.

9.1.4 All dimensions shall be in SI units.

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9.2 Documentation

- 9.2.1 The contractor/manufacturer/vendor shall provide the specific parts full data and documentation as specified in specified in Scope of Work & Technical Specifications (SOW/TS) or TBL Quotation Request Package (instructions to vendors) and Non-Material Requirements (e.g. Drawings for approval, certified drawings and operating manuals) attached to the Quotation Request and subsequently to the Purchase Order.

comply

comply

- 9.2.2 Unless otherwise specified in Scope of Work & Technical Specifications (SOW/TS) or Quotation Request Package and/or Non-material Requirements referred in clause 9.2.1 above, the following documents shall be submitted:

- a. The contractor/manufacturer/vendor shall submit six (6) copies of the quotation along with Data Schedule duly filled in and six (6) sets of outline general arrangement drawings of the equipment/material showing dimensions, assembly and mounting details in both printed and electronic format version for TBL's evaluation and acceptance.

Technical literature, catalogs and certified Type Test reports conducted at Independent Test Laboratories or witnessed by TBL approved QA/QC Services Contractors, for the proposed or identical equipment/material shall also be submitted for TBL's evaluation and acceptance.

- b. The contractor/manufacturer/vendor, upon receipt of Purchase Order, shall submit two (2) sets of the preliminary design drawings including where applicable, the control schemes and wiring diagrams, information about static and dynamic loads of the equipment/material for TBL review and acceptance.

The contractor/manufacturer/vendor shall not proceed with the manufacture until such acceptance is received in writing from TBL.

- c. The contractor/manufacturer/vendor, upon shipment of the equipment/material, shall supply six (6) copies of the following approved drawings and other documents for record and future use:

- i. Detailed manufacturer's instruction/maintenance manuals, with nameplate details and specification, covering the safety precaution, recommended erection, operation and maintenance procedures of the equipment/material, including mechanical/electrical tolerances for installation, maintenance/ repair purposes and troubleshooting.

- ii. Certified Type, Routine and Special Test Reports, Certificates, Data and Characteristic Curves.

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- iii. List of component parts and complete sets of exploded view drawings with comprehensive manufacturer's parts identification or catalog numbers for each device identified, to enable TBL to catalog and order.
- iv. Complete list of manufacturer's recommended Start-up/ Operation and Maintenance Spares of the equipment/material for at least two (2) years of successful and trouble-free operation.

9.3 Specific requirements as stipulated in the Quotation Request Package or Scope of Work & Technical Specifications (SOW/TS) shall also be complied with.

10.0 EXCEPTIONS

- comply
- 10.1 The contractor/manufacturer/vendor shall furnish a clause by clause compliance of this Specification and the associated TMSSs clearly indicating the provisions/features of the tendered equipment/material.
- 10.2 The contractor/manufacturer/vendor shall clearly state and give a list of deviations or exceptions. Every exception/deviation shall indicate:
- 10.2.1 Applicable clause/section of this Specification and/or the associated TMSS, as applicable.
 - 10.2.2 Reasons for the exceptions or deviations.
- 10.3 TBL reserves the right to reject any or all of the exceptions/deviations without assigning the reasons thereof.

Insulation Levels

Table - 5

4.6.1 Common Values: *Not Applicable*

| Insulation Level | | 11 | | 13.8 | | 33 | | 34.5 | | 69 | | | 110 | | | 115 | | | 132 | | | 230 | | |
|---------------------|----------|---|-------------|-----------|-----------|-----|-----|-----------|-----------|-----|-----|-----|-----|-------------|-------------|-------------|-------------|-------------|-------------|-------------------------------|-------------|-------------|-------------|------|
| | | 110 | 110 | 50/ 45 | 50/ 45 | 200 | 200 | 95/ 80 | 95/ 80 | 325 | 325 | 350 | 350 | 160/ 140 | 160/ 140 | 230/ 230 | 305/ 275 | 275/ 275 | 230/ 230 | 305/ 275 or 355/ 325 | 275/ 275 | 650/ 750 | 650/ 750 | 1050 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| External Insulation | Outdoors | BIL(kV peak) | 110 | 110 | 200 | 200 | 200 | 95/ 80 | 95/ 80 | 325 | 325 | 350 | 350 | 160/ 140 | 160/ 140 | 230/ 230 | 305/ 275 | 275/ 275 | 230/ 230 | 305/ 275 or 355/ 325 | 275/ 275 | 650/ 750 | 650/ 750 | 1050 |
| | | Power Frequency withstand Voltage (Dry/Wet) (kVrms) | 50/ 45 | 50/ 45 | 200 | 200 | 200 | 95/ 80 | 95/ 80 | 325 | 325 | 350 | 350 | 160/ 140 | 160/ 140 | 230/ 230 | 305/ 275 | 275/ 275 | 230/ 230 | 305/ 275 or 355/ 325 | 275/ 275 | 650/ 750 | 650/ 750 | 1050 |
| | | BSL (kV _{peak}) | | | | | | | | | | | | | | | | | | | | | | |
| | Indoors | BIL(kV peak) | 95 | 95 | 170 | 170 | 170 | 95/ 80 | 95/ 80 | 325 | 325 | 350 | 350 | 160/ 140 | 160/ 140 | 230/ 230 | 305/ 275 | 275/ 275 | 230/ 230 | 305/ 275 or 355/ 325 | 275/ 275 | 650/ 750 | 650/ 750 | 1050 |
| Internal Insulation | | Power Frequency Withstand Voltage (kVrms) | 36/ 38** | 36/ 38 | 70 | 70 | 70 | 36/ 38 | 36/ 38 | 140 | 140 | 140 | 140 | 140 | 140 | 230 | 255 | 230 | 230 | 255/ 305 | 275/ 275 | | | 435 |
| | | BSL (kV _{peak}) | | | | | | | | | | | | | | | | | | | | | | 395 |
| | | BIL (kV peak) | 95 | 95 | 170 | 170 | 170 | 95/ 80 | 95/ 80 | 325 | 325 | 350 | 350 | 160/ 140 | 160/ 140 | 230 | 255 | 230 | 230 | 255/ 305 | 275/ 275 | | | 435 |
| | | Power frequency withstand voltage (kV rms) | 36/ 38** | 36/ 38 | 70 | 70 | 70 | 36/ 38 | 36/ 38 | 140 | 140 | 140 | 140 | 140 | 140 | 230 | 255 | 230 | 230 | 255/ 305 | 275/ 275 | | | 435 |

* - Can be used in areas where the existing insulation level already proven for minimum 5 years subject to SEC review and acceptance.
 ** - Unless otherwise specified in the SOW/TS, power frequency withstand value for switchgear shall be 38 kV and for other equipment it shall be specified in the SOW/TS.

G - Values Applicable for GIS only.

T - Values Applicable for transformer bushing only (Indoor and outdoor).

B - Values Applicable for all bushing (GIS, Transformer and other equipment).

O - Values applicable for Other Equipment



4.6.2 Across Isolating Distance: *Not Applicable*

Table - 6

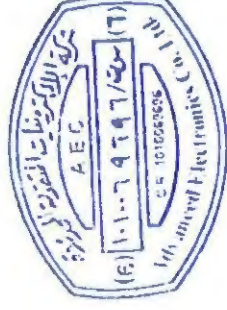
| External Insulation Level | System Nominal Voltage (kVrms) | 11 | 13.8 | 33 | 34.5 | 69 | | 110 | | 115 | | 132 | | 230 | |
|---------------------------------|--|-------------|-----------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------------------|---------|---------|
| | | | | | | G | O | G | O | G | O | G | O | G | O |
| | | | | | | 375 | 385 | 630 | 750 | 630 | 750 | 750 | 750/860 | 1200 | 1200 |
| Outdoors | BIL(kV peak) | 125 | 125 | 220 | 220 | 375 | 385 | 630 | 750 | 630 | 750 | 750 | 750/860 | 1200 | 1200 |
| | Power Frequency withstand Voltage (Dry/Wet) (kVrms) | 55/ 50 | 55/ 50 | 105/ 88 | 105/ 88 | 160/ 160 | 176/ 154 | 265/ 265 | 315/ 315 | 265/ 265 | 315/ 315 | 315/ 315 | *315/315 or 375/375 | 530/530 | 530/530 |
| Indoors | BIL(kV peak) | 110 | 110 | 195 | 195 | 375 | 375 | 630 | 630 | 630 | 630 | 750 | *630/750 | 1200 | 1050 |
| | Power Frequency withstand Voltage (kVrms) | 40/ 45** | 40/45** | 80 | 80 | 160 | 160 | 265 | 265 | 265 | 265 | 315 | *265/315 | 530 | 460 |

* - Can be used in areas where the existing insulation level already proven for minimum 5 years subject to SEC review and acceptance.

** - Unless otherwise specified in the SOW/TS, power frequency withstand valued across isolating distance for switchgear shall be 45 kV and for other equipment it shall be specified in the SOW/TS.

G - Values Applicable for GIS only.

O - Values applicable for other equipment



4.6.3 Insulation Levels for 380kV System: *Not Applicable*

Table - 7

| System Nominal Voltage (kVrms) | | 380 | | | | | | |
|--------------------------------|--|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|---|
| Insulation Level | | | G | T | O | OB | Across Open Switching Device and for Isolating Distance | |
| | | | Phase to Earth and Between Phases | Phase to Earth and Between Phases | Phase to Earth and Between Phases | Phase to Earth and Between Phases | Across Open Switching Device and for Isolating Distance | Across Open Switching Device and for Isolating Distance |
| | | | | | | | | |
| External Insulation Level | Outdoors | BIL(kV peak) | 1425 | 1425 | 1425 | 1425 | 1425(+240) | 1425(+315) |
| | | Power Frequency Withstand Voltage ** (Dry/Wet) (kVrms) | 650/650 | 695/695 | 620/620 | 630/630 | 815/815 | 800/800 |
| | Indoors | BIL(kV peak) | 1425 | 1300 | 1300 | 1300 | 1425(+240) | 1300 (+240) |
| | | Power Frequency Withstand Voltage (kVrms) | 650 | 625 | 520 | 570 | 815 | 610 |
| Internal Insulation Level | Power Frequency Withstand Voltage (kV rms) | BIL (kV peak) | | 1300 | 1300 | NA | NA | NA |
| | | | | 520 | 520 | NA | NA | NA |

G - Values applicable for GIS.

T - Values applicable for transformer bushing only (Outdoor and Indoor).

OB- Values applicable for Other Bushing (Other than transformer and GIS busing).

O - Other Equipment.

